

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/336,525 | 06/18/1999 | JUDY HUANG | AMAT/3577/PD | 7748 |

7590 03/15/2002

PATENT COUNSEL
APPLIED MATERIALS INC
LEGAL AFFAIRS DEPARTMENT
P O BOX 450A
SANTA CLARA, CA 95052

EXAMINER

PADGETT, MARIANNE L

| ART UNIT | PAPER NUMBER |
|----------|--------------|
|----------|--------------|

1762

11

DATE MAILED: 03/15/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/336,525

Applicant(s)

Judy Huang

Examiner

M.L. Padgett

Group Art Unit

1762

— The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address —

P riod for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- ☒ R sponse to communication(s) filed on 10/12/01
- ☐ This action is **FINAL**.
- ☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- ☒ Claim(s) 24-26, 28, 30-38, 40, 42-45 is/are pending in the application.
- Of the above claim(s) _____ is/are withdrawn from consideration.
- ☐ Claim(s) _____ is/are allowed.
- ☒ Claim(s) 24-26, 28, 30-38, 40, 42-45 is/are rejected.
- ☐ Claim(s) _____ is/are objected to.
- ☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

- ☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.
- ☐ The drawing(s) filed on _____ is/are objected to by the Examiner
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

Pri rity under 35 U.S.C. § 119 (a)-(d)

- ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).
- ☐ All ☐ Some* ☐ None of the:
- ☐ Certified copies of the priority documents have been received.
- ☐ Certified copies of the priority documents have been received in Application No. _____.
- ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____

Attachm nt(s)

- ☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____
- ☐ Interview Summary, PTO-413
- ☐ Notice of Ref rence(s) Cited, PTO-892
- ☐ Notice of Informal Patent Application, PTO-152
- ☐ Notice of Draftsperson's Patent Drawing Review, PTO-948
- ☐ Other _____

Office Action Summary

Art Unit: 1762

1. The request filed on 10/12/01 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 09/336,525 is acceptable and a CPA has been established. An action on the CPA follows.

2. On page 7 of paper no. 5, in their remarks, applicants state that claims 34-45 are intended to be interpreted under 35 U.S.C 112, paragraph 6, and stated that all amendments are supported by the specification, but cited no actual support. (This is not and has never been an "objection").

In claim 34, in line 2, "step for depositing..." meets the criteria for paragraph 6 interpretation. The other "step for..." limitations have been removed by the amendment B of 9/17/01, paper # 8, hence are no longer defined by paragraph 6 language.

The specification was previously reviewed for the meaning under **paragraph 6** of the claimed "step for depositing...", for the claimed first layer materials of "organic polymer materials, α C, α FC, SiCOH and SiC". No "step for depositing" language was found. NO deposition techniques for any materials of the first layer, except SiC was found (page 6, R.F. plasma with specific conditions and materials, clearly not applicable to all of the claim 34 Markush group). Paragraph 6 interpretation requires that the limits for how depositing takes place for the first layer be defined from disclosures of the specification. If there are no definitions of the limits of the deposition techniques for the other taught and claimed materials, there is no meaning under 112, paragraph 6 for those deposits. This does not mean that the specification does not teach their

Art Unit: 1762

deposition, but does not provide a viable 112 ¶6th interpretation for the claimed “step for depositing” that provides required limits.

Ex. 4 on p. 11, only provides 112 ¶6th definition for SiC, and the dual damascene discussion on p. 12-15 is again only for SiC, where the discussion could be said to imply that CVD or plasma CVD processes were used for the 2nd layer, especially where *in situ* processes were discussed, however applicants’ summary (page 2) and other sections of the specification make it clear that *in situ* is only preferred, not required, so can NOT be said to define what range of disposition processes are included by applicant’s paragraph 6 terminology. Also, discussions of post deposition treatments, do NOT define the deposition step, hence provide no support for 112, 6th paragraph definition of “step for deposition a first layer”.

As one of ordinary skill in the art would have no reason to confine depositions of organic polymer to the plasma CVD process used to deposit SiC, and as neither the claimed chemical formulas of α FC or SiCOH represent real compounds (see below rejection), there remains no apparent difference in scope between the deposition steps of claims 24 and 34 (except for the SiC option), i.e., any process of layer deposition will read on these claims. For this reason, dependent claims 35-36, 38-39, 42-43 and 45, have scopes defined by claim 34, but claim 37, which is limited to SiC has the first “step for depositing...” defined by the disclosure as limited to RF plasma CVD and its equivalents.

3. Applicants have stated (p. 6 response 9/17/01) that P.N. 5,000,113 to Wang et al on page 4; to P.N. 4,951,601 to Maydan et al on page 15; and the three applications 09/165,248

Art Unit: 1762

(page 5); 09/219,945 (page 6) and 09/193,920 (page 13) incorporate no essential material, therefore the objection is withdrawn, and it is noted that no information there in may be used to define the claims, etc. (M.P.E.P. 608.01(P)).

4. The 112, 1st paragraph rejections concerning the materials as disclosed on p. 2, lines 14-20, and in the claims are withdrawn., because applicants have stated on the record that the listings are only intended to show that deposits contain those elements. (p. 7 of 9/17/01 responses, thus creating file wrapper estoppel.

5. Claims 34-36, 38, 42, 43, and 45 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 34, and its dependents as described above in section 2, the meaning of “step for depositing...” for the first layer is of unclear scope. As pointed out above, one of ordinary skill would not find the act of depositing adequately defined by the specification to determine what range of deposition processes are necessarily defined or supported by the specification under 112 paragraph 6, except in the incidence of SiC deposits.

6. Claims 33 and 45 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no evidence or suggestion in the specification, that inert gas, plasma treatment of organic polymers, or α -C, or “ α FC”, or “SiCOH, or “SiCO:H”, will

Art Unit: 1762

have no composition changes caused by the plasma treatments. Figure 2, line A, described on page 6 provides support for these claims, only for SiC layers. A case could be made for amorphous carbon (α C) with absolutely no impurities, having no change in chemical composition, but applicants' specification provides no evidence for a like extrapolation to other claimed compounds, whose chemistry would not be the same (or is totally unknown as claimed), hence can not be said to be homologous. Applicant's citation of p. 5, line 21-24 provides absolutely NO support for or evidence of no compositional changes

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 24, 26, 27, 30-36, 38, 42 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al ('935), in view of Itoh et al (German patent).
Nguyen et al's technical field is for processing integrated substrates, including semiconductors

Art Unit: 1762

(col. 1, lines 9-17), and while applicants have now limited their claim to depositing the first layer on a semiconductor substrate, the reference teaches silicon substrates with a first layer being Si-containing. Part of Nguyen et al's process is coating all of the chamber with polymeric fluorocarbon, where these films exhibit predominately C-CF_x binding with a F/C ratio of about 1:1 to about 3:1 (col. 6, lines 44-53 and claims 10 and 16). These same deposits are also applied to the composite substrate. While Nguyen et al does not discuss whether or not the polymers are amorphous in structure, such is a typical morphology for plasma polymerized deposits, hence maybe considered inherent, or alternately obvious due to their taught highly crosslinked and dense form. As applicants have stated that "FC" is not a chemical formula, but indicates elements of the deposit, the range of F/C ratios taught by Nguyen et al reads on such deposits. It also reads on the option of organic polymeric material. For deposition on the chambers, the initial coating phase, see col. 3, lines 31- col. 4, line 4.

After precoating the chambers, electrodes and walls, the substrates are placed in the chamber and treated with a plasma of Ar, or alternately another inert gas, such as He (col. 2, lines 58- col. 3, line 9; and col. 4, lines 5-33). Then continuing processing in the same chamber, another fluorocarbon film is plasma deposited, that will form on both the substrate and the chamber surfaces that were precoated (col. 4, lines 34-col. 6, lines 53; and Examples). Particularly note the teaching that the positive ion bombardment that takes place, creates films with high density that tend to resist taking up oxygen from air (col. 6, lines 28-30). In Nguyen et al, see the abstract; col. 1, lines 9-17; col. 2, lines 22-45 and col. 3, lines 18-47 for plasma deposition (i.e., plasma

Art Unit: 1762

treatment) on a substrate that may be silicon, contain Si, and/or have thereon an initially applied coating that may be silicon containing, including silicon oxides or silicon nitride (col. 2, lines 58-62 and Ex. 1 on col. 6-7), where the substrate was in situ plasma cleaned (discussed above). Note Ex. 1, where the Si substrate with Si_3N_4 layer is Ar-plasma treated, then C_xF_y is deposit thereon. Gases, such as C_2F_4 , etc., may be input at a rate of about 20-150 sccm, with initial RF power densities being about 0.02 to 0.05 W/cm^2 , with pressures during the initial plasma deposition of about 200 mtorr. While Nguyen et al's silicon containing multilayer substrates are generically inclusive of SiC or SiCOH containing layers on Si (ie. semiconductor) substrates, as claimed by applicant, their specific examples differ by not including these compounds/materials as the top or first layer on their Si-containing compound substrate.

The German patent to Itoh et al (see the translation: on page, 2; page 3, lines 1-8; page 5, 5-6th paragraphs; page 7, bottom; page 9 esp. last full paragraph; page 10, etc), teaches semiconductor devices having various layers, inclusive of an intermediate insulation layer containing Si, O, C and H, where the amount of C is not less than that of Si, via a CVD process, possibility a plasma process. This intermediate layer has formed on it another insulating film that is from a different material. Given these teachings, it would have been obvious to one of ordinary skill in the art, that the silicon containing layer on a Si substrate, that is Ar-plasma treated, then deposited with a fluorocarbon insulting layer in Nguyen et al, could have been effectively supplied by the intermediate layer of Itoh et al, because it fits all the necessary criteria of Nguyen et al, is a

Art Unit: 1762

Si oxide derivative, hence analogous to the exemplary silicon oxide, and is desired to be used with a different insulative layer deposited on it, thus for like purposes.

In Nguyen et al, the parameters for the inert gas plasma cleaning process include RF power of 100-1000 watts, gas flow (Ar) of about 20-150 sccm, pressures of about 10-100 mtorr (.01-.1 torr) and a self bias of about -400 to -700 volts. While the flow rates overlap with applicant's claimed range, the pressure ranges just miss overlapping at about .1 torr and about 1 torr, this is not a significant amount thus an obvious variation and consistent with "about". Power and power density are not measuring the same quantities, hence power can not be directly compared by the PTO with the information given. It would have been obvious to one of ordinary skill in the art to determine power/power density relationships, and optimize them for particular reactor configurations, variations in gas pressure, etc., as well as for the particular materials being treated, plus desired effect of cleaning, but not reacting, thus like ranges of optimization for variations in apparatus, etc... would have been expected.

9. Claims 24, 26, 33-34, 36, 38 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mori.

In Mori, see the abstract, col. 1, line 5-25+; col. 4, lines 1-27 and 56-68; col. 5, lines 23-38; col. 6, lines 43-53; col. 11, lines 9-29; col. 12, lines 33-52; etc., for a process where the substrate maybe a Si wafer, and where a coating of an organic polymer, or a SOG (spin-on-glass layer of Si oxide that may contain hydrocarbon residues, therefore is composed of Si, C, O and H as claimed) is treated with a plasma. Note, as seen on col. 11, lines 9-29 that the plasma may

Art Unit: 1762

initially be only made from helium, hence reading on applicant's exposing step which requires essentially inert gas in the plasma. Since the overall process claimed may comprise any other number of steps besides those listed, it does not matter that the He plasma is followed by a reactive gas plasma exemplified by $\text{CF}_4 + \text{He}$, as such is inclusive of the broad claim language. Note that neither the He plasma, nor the reactive plasma used in removing edge beads, etc., changes the composition of the remaining polymer or SOG layer. Mori's process is implicitly for treating a layer in a semiconductor device that will be multilayered, hence the presence of semiconductor in the substrate which has been coated is considered given. Mori does not explicitly follow the plasma treatment steps with another coating, however it would have been obvious to one of ordinary skill that any of the dielectric or masking layers discussed by Mori are only one of a series of layers that would have been expected to be followed by subsequent layers, in all cases except the final capping layer. Any such subsequent layer reads on the claimed generic deposit of the second layer.

10. Claims 24-26, 28, 30-38, 40 and 42-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nguyen et al (935) as discussed above in section 8, in view of Tanabe et al.

As noted above, Nguyen et al teach generic silicon containing coating on their composite substrates, where the substrate itself maybe Si, but not SiC containing compositions specifically for use in semiconductor processing, however Tanabe et al (Abstract; col. 1, lines 5-18; col. 7, lines 30-36; col. 8, lines 56-65 and col. 10, lines 43- col. 11, lines 20+; and col. 12, lines 12-20)

Art Unit: 1762

shows that use of SiC as an intermediate on semiconductor substrates, such as Si, prior to the deposition of a carbeneous layer of diamond. The SiC maybe deposited by various possible plasma CVD techniques, is shown to have been known in the semiconductor art, with notice taken that diamond related deposits, unless doped, are generally electrically insulating, hence it would have been obvious from teachings of Tanabe et al to use materials as SiC as a Si-containing intermediate on Si substrates in the process of Nguyen et al for reasons analogous to those applied in section 8 for alternative specific Si-containing layers, and because Tanabe et al shows SiC to be desirable for adhesion of subsequent carbon based coating, hence expected to be effective.

It is further noted that all processes in this combination are plasma processes, with Ar plasma treatment and the CF-containing deposit specifically being done in the same chamber. There Is no specific teaching of the first layer (Si-containing) and the exposing being done in the same chamber, however when all processes required are consistent with one plasma apparatus's capabilities, it would have been obvious to one of ordinary skill in the art, that all those plasma process could be preformed in the same chamber depending on production line efficiencies, especially as exposing and deposition have already been shown to be preformed in one chamber.

11. Also, of interest were Batha et al with further plasma CVD of SiC techniques, and Goel et al a and Koike et al, who both teach use of SiC as an underlayer before DLC deposits, with teachings of inert gas plasmas cleaning before the claimed coating, but are not discussing

Art Unit: 1762

semiconductor substrates, however would be cumulative to Tanabe et al above for further motivating inert gas plasma used in the above combination, where SiC is specifically involved.

Malaczynski et al , previously applied remains of interest, but use conducting substrates (Al-Si alloy), not semiconducting in a process that is otherwise as claimed.


12. Applicant's arguments filed 9/17/01 and discussed above have been fully considered but they are not persuasive.

13. Any inquiry concerning this communication should be directed to M.L. Padgett at telephone number (703) 308-2336 on Monday-Friday fro about 8:00 am-4:30 pm, and Fax # (703) 305-5408 (official) or 305-6078 (unofficial).

MLPadgett:evh

3/12/02

3/14/02



MARIANNE PADGETT
PRIMARY EXAMINER
GROUP 1700